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EFFECT OF PLANTING TIME AND LEVELS OF NITROGEN ON GROWTH, FLOWERING AND YIELD OF GAILLARDIA *(*GAILLARDIA PULCHELLA FOUGER) CV. DOUBLE YELLOW UNDER SOURTH GUJARAT CLIMATIC CONDITIONS

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ABSTRACT

The effect of planting time *viz.*, 1st September, 1st October, 1st November and 1st December and levels of nitrogen i.e., 0.0 kg /ha, 80 kg/ha, 130 kg/ha and 180 kg/ha on growth, yield parameters of gaillardia was investigated. Among the planting time, October planting significantly increased plant height, number of branches, number of leaves per plant, induced early emergence of flower bud to full blooming of flowers, longer duration of flowering, improved flower fresh and dry weight and enhanced flower yield in terms of number of flowers per plant and flower weight per plant. Among different levels of nitrogen, significantly early bud emergence to full blooming of flowers and flower longevity on plant and fresh and dry weight of ten flowers was observed with 130 Kg N/ha. Thus, among all treatment combinations, the October planting with 130 Kg nitrogen per hectare proved superior in terms of growth, flowering and yield attributes *viz.* plant height, number of branches and leaves per plant, duration of flowering, number of flowers per plant and weight of flowers per plant.

KEYWORDS: Gaillardia, Nitrogen Levels, Planting Time

INTRODUCTION

Gaillardia *(Gaillardia pulchella* Fouger) is an economically important seasonal flower mainly cultivated for loose flower production, it also used as cut flower as well as in landscape gardening. It is grown throughout the year in many part of country, but not commercially, perhaps due to lack of scientific investigation under local agroclimatic conditions on its standardisation of horticultural practice, hence present paper gives the information about the planting time and nitrogen requirement of gaillardia cv. Yellow Double for obtaining higher yield.

MATERIALS AND METHODS

Studies were carried out at Department of Horticulture, N.M. College of Agriculture, NAU, Navsari in the *rabi* season in split plot design with four date of planting *viz.* first day of September (D_1), October (D_2), November (D_3) and December (D_4) as main treatments and four levels of nitrogen *i.e.* control 0.0 kg N/ha (N_0), 80 kg N/ha (N_1), 130 kg N/ha (N_2) and 180 kg/ha (N_3) as sub-treatments which were replicated thrice. The one month old seedlings were planted at 45 x 30 cm spacing in the experimental plot as per treatments of planting time. 15 t/ha FYM, 60 Kg/ha each P_2O_5 and K_2O along with 1/3 nitrogen were applied in the soil at the time of transplanting and remaining quantity of nitrogen was given in two equal split doses at monthly intervals. All the recommended package of practices was followed to raise a good crop.

Five competitive plants were marked in each net plot per replication and the observations were recorded on various growth, flowering and yield parameters on these plants.

RESULT AND DISCUSSIONS

Growth

Effect of Planting Date

It is evident from Table 1 that vegetative growth of gaillardia was markedly influenced by the planting time and the significantly maximum plant height was recorded with October planting (75.45 cm), being at par with November planting (71.83 cm). Planting time was significantly influenced the number of branches and number of leaves per plant (Table 1) and maximum number of branches (21.80) and number of leaves (1146.75) was observed in October planting. The increase in plant height, number of branches and number of leaves in October planting may be due to favourable growing conditions which might have resulted in luxuriant growth of these vegetative characters. The results are in accordance with finding of Sharma, *et al.* (2013) in paper flower, Patil, *et al.* (2005) in gaillardia and Bhardwaj and Kumar (2001) in chincherinchee.

Effect of Levels of Nitrogen

All four levels of nitrogen under study showed significant variation in plant height and it was maximum at 130 KgN/ha (71.47 cm), followed by 180 KgN/ha (77.00 cm) and 80 KgN/ha (64.42 cm). Significantly maximum number of branches (19.93) and number of leaves (935.00) per plant was obtained under 130 KgN/ha, being at par with 180 KgN/ha (18.8 and 1104.33, respectively). The increase in vegetative growth of the plant might be attributed to the association of nitrogen in the formation of amino acids, which play vital role in increasing meristematic activities and hence the vegetative growth increases. Similar variation in plant height due to nitrogen levels was also noticed previously in gaillardia (Karetha, *et al.*, 2011 and Mishra, 1998); Chrysanthemum (Sajid and Amin, 2014 and Parekh, *et al.*, 2010). The interaction between planting time and levels of nitrogen was significant for plant height and maximum plant height (85.85 cm) was recorded under 130 KgN/ha with October planting.

Flowering

Effect of Planting Date

Table 2 elucidates that planting time exerted significant effect on flower bud emergence and time taken for first full blooming. October planting induced earliest flower bud initiation (53.86 DAT) and took shortest time for first full blooming (82.08 DAT), being at par with November planting (89.64) for full blooming. Significant influence of planting time on duration of flowering was observed and it was longest at October planting (110.52 days) followed by December planting (96.90 days) and September planting (91.95 days). Similar effect of planting time was also noticed by Sharma, *et al.* (2013) in paper flower and Patil, *et al.* (2005) in gaillardia.

Effect of Levels of Nitrogen

The application 130KgN/ha produce earliest visible flower bud (66.48 DAT) and earliest full blooming (84.01 DAT). The earliness of flowering as a result of an application of nitrogen at optimum level might have accelerated the development of vegetative phase. Thus initially reproductive phase started earlier and have also accelerated protein synthesis thus promoting earlier floral primordial development hence early flowering. Similar effects were also obtained by Bhattacharjee *et al. (1982) in* hippeastrum. Among the nitrogen levels, significantly maximum duration of flowering was

recorded in 130 KgN/ha (100.10 days). Among interactions, D_2N_3 (*i.e.*, October planting and 130 KgN/ha) resulted in the maximum duration of flowering (123.37 days), being at par with D_2N_4 (119.44 days) and D_2N_2 (110.89 days). Earliness in flowering with extended flowering duration caused by nitrogen application is in consonance with the finding of Belgaonkar *et al*. (1997) in chrysanthemum.

Flower Yield

Effect of Planting Date

Among planting time, October planting gained significantly maximum fresh weight (43.62 g/10 flowers) and dry weight (10.77 g/10 flowers), being at par with November planting (40.36 g/10 flower and 9.94 g/10 flower, respectively). Treatment D_3 (October planting) produced significantly higher number of flowers per plant (171.69) over all other treatments. Weight of flowers per plant was noted to be significantly higher with October planting (519.00 g/plant). Increase in flower production is because October planting could provide sufficient time and favourable environmental conditions for better growth hence have increased number of flowers and ultimately the yield. These results similar to findings of Mishra (1997) and Samantaray *et. et.*, (1999) in marigold.

Effect of Levels of Nitrogen

The nitrogen application influenced significantly the fresh weight and dry weight of ten flowers over control and the maximum fresh weight of ten flowers (41.53 g) and dry weight of ten flowers (10.39 g) was recorded with N_2 (130 KgN/ha), being at par with N_3 *i.e.*, 180 KgN/ha (40.22 g and 10.21 g, respectively). Nitrogen application at the rate of 130 K g/ha recorded significantly maximum number of flowers (124.46). The value for flower yield significantly increased with each increment in the dose of nitrogen up to 130kg N/ha (371.03g/plant). Further increase in dose showed negative response. The increased flower production under optimum dose of N might be due to more number of branches and photosynthetic area. The results were close to findings of Karetha, *et al.* (1993) and Mishra (1998) in gaillardia. The interaction effect of DxN was recorded significant variation for number of flowers and weight of flowers per plant and was maximum with D_2N_2 (197.67 and 509.00 g/plant, respectively), being at par with D_2N_3 (192.03 and 752.00 g/plant, respectively). Similar observations were made by several workers (Mishra, 1998 in gaillardia and Barman and Pal, 1999 in chrysanthemum).

From this study, it can be concluded that the application of 130 KgN/ha with October planting proved superior in terms of growth, flowering and yield attributes *viz.* plant height, number of leaves per plant, duration of flowering, number of flowers per plant and weight of flowers per plant flowers per plant.

Table 1: Effect of Planting Time and Levels of Nitrogen on Plant Height, number of Branches and Number of Leaves Per Plant on GAILLARDIA *(Gaillardia Pulchella* Fouger) Cv. Yellow Double

Treatment	Plant Height (cm)					Number of Leaves Per Plant					Number of Branches Per Plant				
	1st September (D_1)	1st October (D_2)	1st November (D_3)	1st December (D_4)	Mean	1st September (D_1)	1st October (D_2)	1st November (D_3)	1st December (D_4)	Mean	1st September (D_1)	1st October (D_2)	1st November (D_3)	1st December (D_4)	Mean
Control (N_0)	53.22	68.19	63.54	46.52	57.86	876.67	946.67	928.67	795.00	886.75	13.29	17.76	15.75	10.35	14.29
80 kg N/ha (N_1)	55.92	76.44	72.70	52.63	64.42	908.33	1059.67	990.00	828.33	946.58	16.48	22.23	18.21	12.49	17.35
130 kg N/ha (N_2)	66.99	85.85	73.47	59.55	71.47	1043.00	1316.67	1143.00	935.00	1109.42	18.48	24.24	21.55	15.45	19.93
180 kg N/ha (N_3)	62.18	71.30	77.62	56.93	67.00	1010.33	1264.00	1104.33	900.00	1069.67	17.90	22.98	19.94	14.66	18.87
Mean	59.58	75.45	71.83	53.91		959.58	1146.75	864.58			16.54	21.80	18.86	13.24	
C.D. (P = 0.05)	D	N	DXN			D	N	DXN			D	N	DXN		
	7.17	2.40	2.40			39.52	127.53	39.52			2.01	1.01	NS		

Table 2: Effect of Planting Time and Levels of Nitrogen on Emergence of flower Bud, Full Blooming of Flower and Duration of Flowering of Gaillardia *(Gaillardia pulchella* Fouger) Cv. Yellow Double

Treatment	Emergence of Flower Bud (Days After Transplanting)					Full Blooming of Flower (Days After Transplanting)					Duration of Flowering (Days)				
	1st September (D_1)	1st October (D_2)	1st November (D_3)	1st December (D_4)	Mean	1st September (D_1)	1st October (D_2)	1st November (D_3)	1st December (D_4)	Mean	1st September (D_1)	1st October (D_2)	1st November (D_3)	1st December (D_4)	Mean
Control (N_0)	84.45	61.35	74.17	96.40	79.09	108.80	91.41	97.80	116.30	103.60	80.02	88.37	82.39	69.60	80.10
80 kg N/ha (N_1)	78.24	57.25	67.92	93.24	74.16	99.69	83.29	91.01	108.59	95.65	86.92	110.89	91.33	78.64	91.95
130 kg N/ha (N_2)	70.25	48.29	60.90	86.46	66.48	92.95	74.48	84.01	101.00	88.11	92.05	123.37	99.05	85.95	100.10
180 kg N/ha (N_3)	73.55	48.55	64.42	90.07	69.15	95.97	79.17	85.73	104.03	91.23	89.93	119.44	93.80	84.40	96.90
Mean	76.62	53.86	66.33	91.55		99.37	82.08	89.64	107.48		87.23	110.52	91.64	79.65	
C.D. (P = 0.05)	D	N	D X N			D	N	D X N			D	N	D X N		
	9.56	2.29	NS			13.93	2.75	NS			13.00	2.35	4.71		

Table 3: Effect of Planting Time and Levels of Nitrogen on Fresh and Dry of Flowers and Diameter of Flower of Gaillardia *(Gaillardia Pulchella* Fouger) Cv. Yellow Double

Treatment	Fresh Weight of 10 Flowers (g)					Dry Weight of 10 flowers (g)					Diameter of Flower (cm)				
	1st September (D_1)	1st October (D_2)	1st November (D_3)	1st December (D_4)	Mean	1st September (D_1)	1st October (D_2)	1st November (D_3)	1st December (D_4)	Mean	1st September (D_1)	1st October (D_2)	1st November (D_3)	1st December (D_4)	Mean
Control (N_0)	31.48	35.28	33.43	25.35	31.39	7.67	8.80	7.77	7.49	7.93	5.08	5.26	5.21	5.01	5.18
80 kg N/ha (N_1)	38.52	43.64	41.21	30.48	38.46	9.08	10.96	10.24	8.79	9.77	5.24	5.38	5.29	5.15	5.28
130 kg N/ha (N_2)	40.73	48.90	44.08	32.42	41.53	9.45	11.78	11.03	9.31	10.39	5.34	5.51	5.41	5.40	5.42
180 kg N/ha (N_3)	39.50	46.65	42.74	31.99	40.22	9.36	11.52	10.70	9.26	10.21	5.32	5.45	5.34	5.27	5.30
Mean	37.56	43.62	40.36	30.06		8.89	10.77	9.94	8.71		5.24	5.40	5.31	5.21	
C.D. (P = 0.05)	D	N	D X N			D	N	D X N			D	N	D X N		
	6.18	1.43	NS			1.07	0.21	0.44			NS	NS	NS		

Table 4: Effect of Planting Time and Levels of Nitrogen on Number of Flowers and Weight of Flowers per Plant of Gaillardia (*Gaillardia Pulchella* Fouger) Cv. Yellow Double

Treatment	Number of Flowers Per Plant (g)					Weight of Flowers Per Plant (g)				
	1st September (D_1)	1st Octcber (D_2)	1st November (D_3)	1st December (D_4)	Mean	1st September (D_1)	1st October (D_2)	1st November (D_3)	1st December (D_4)	Mean
Control (N_0)	77.46	131.64	95.80	58.56	90.86	236.00	344.67	305.00	120.67	151.58
80 kg N/ha (N_1)	88.55	165.41	103.98	69.37	106.83	312.67	615.67	420.67	161.48	277.87
130 kg N/ha (N_2)	108.50	197.67	117.80	79.52	124.46	420.33	762.67	509.00	192.13	371.03
180 kg N/ha (N_3)	101.66	192.03	113.74	76.19	122.31	414.33	752.00	495.00	187.67	362.25
Mean	94.04	171.69	107.83	70.91		245.83	519.00	332.42		
C.D. (P = 0.05)	D	N	D X N			D	N	D X N		
	19.28	3.79	7.58			63.67	11.34	22.68		

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